# Space Weather Technical Forecast

Issued on Wednesday, 20 October 2021 at 13:22 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

**Space Weather Forecast Headline: No significant activity expected.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Solar activity was Very Low, with only A-class flares detected. There is currently one numbered sunspot region on the visible disc, AR2886 (Hsx/Alpha) in the southeast quadrant. This region appears to be stable with a magnetically simple configuration.

No new Earth-directed CMEs (coronal mass ejections) were observed in available imagery at the time of issue. However, a faint CME that was associated with a weak filament lift off from near N30W10 at 17/0739 UTC has been re-analysed. Model results show a possible small chance of a weak side glance around 20/2300UTC, but confidence is low and no significant impacts are expected.

**Solar Wind / Geomagnetic Activity:** Solar wind parameters, as measured by DSCOVR at L1, were at mostly slow-ambient levels, 350 to 400km/s, with a brief peak of 428km/s around 20/0206 UTC. Density values were mainly above average, with several peaks near 27 ppcc between 19/1300-1900 UTC. Total IMF Bt was mostly weak, but with a few brief moderate intervals between 19/1200-1700 UTC. Bz fluctuated between -8 nT and +8 nT. The Phi angle has been mainly negative (towards the sun) with only a few, mainly short-lived rotations into the positive (away from the sun) sector. Resultant geomagnetic activity was Quiet to Unsettled (Kp 1-3), with a period of Active (Kp 4) 19/1500-2100UTC.

**Energetic Particles / Solar Radiation:** The high energy proton flux (greater than 10 MeV) as measured by GOES-16 was at background levels, with no solar radiation storms observed. High energy electron flux (greater than 2 MeV) was at predominantly background levels, but with a peak of 199 pfu at 19/1500 UTC. Associated 24-hour electron fluence remained well below the Active (1e8 integrated pfu) threshold, with 1.91e6 integrated pfu recorded at 20/0000 UTC.

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Solar activity is expected to remain at Very Low levels on day 1 and early day 2 (19th and 20th), with only a slight chance of C-class flares, increasing to a chance of C-class flares from the middle of day 2 onwards.

**Solar Wind / Geomagnetic Activity:** Solar wind speeds will initially be at background to slightly elevated levels. However, the solar wind is likely to become enhanced during days 1 and 2 (20th and 21st) due to the influence of a coronal hole. Solar winds should then reduce again on days 3 and 4 (22nd and 23rd). A weak CME may glance earth late on the 20th, but no significant effects are expected. Geomagnetic activity is likely to be Quiet to Unsettled, with isolated Active intervals, and a very slight chance of isolated G1 minor geomagnetic storms on days 1 and 2. Coronal hole influence is expected to gradually wane through days 3 and 4 with geomagnetic activity returning to mostly Quiet levels.

**Energetic Particles / Solar Radiation:** The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with no solar radiation storms expected. The high

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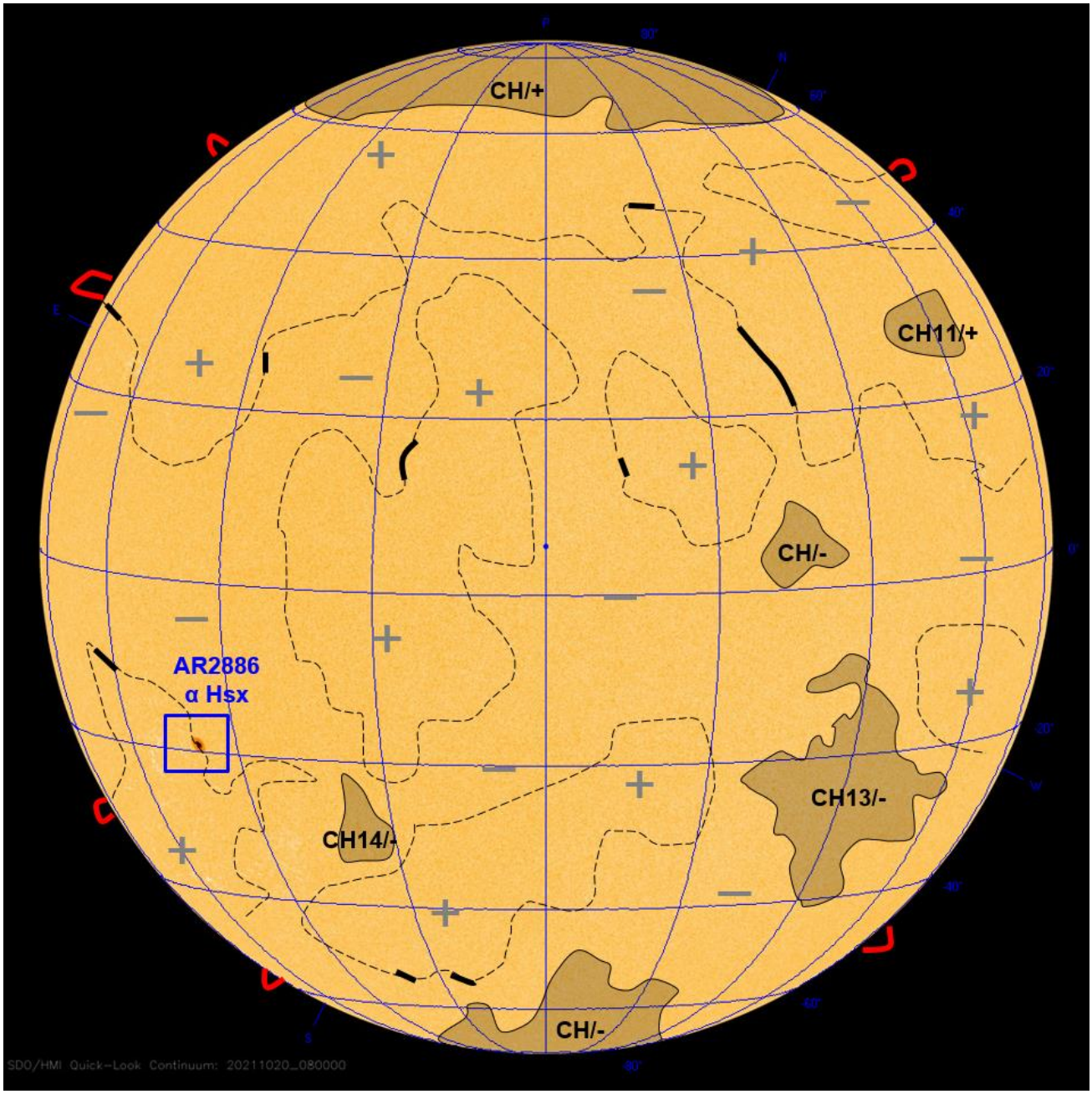
energy electron flux (greater than 2MeV) is expected to be at mostly background to moderate levels, but with an increased risk of high (>1000 pfu) levels from day 2 (21st) onwards. The 24-hour fluence will most likely remain below the Active (1e8) threshold throughout, but probably with a rising trend likely days 2 to 4 (21st to 23rd).

**Figure 1. Solar Analysis Valid 20/0800 UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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# Met Office Space Weather Technical Forecast

## Geomagnetic Storms:

A faint CME that was associated with a weak filament lift off from near N30W10 at 17/0739 UTC has been re-analysed. Model results show a possible small chance of a weak side glance around 20/2300UTC, but confidence is low and no significant impacts are expected.

Solar wind speeds are expected to begin at mainly background levels. However, the solar wind is likely to become enhanced at times during days 1 and 2 (20th and 21st) due to coronal hole influence from CH13/-. Geomagnetic activity is likely to be Quiet to Unsettled, with isolated Active intervals, and a slight chance of isolated G1 minor geomagnetic storms on days 1 and 2. Coronal hole influence is expected to gradually wane through days 3 and 4 (22nd and 23rd), with geomagnetic activity returning to mostly Quiet levels.

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 5 | 5 | 1 | 1 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Geomagnetic Activity - Earthbound Coronal Mass Ejections

| Date/time 21.5R (UTC) | Halo: Full or Partial | Source | Source Location | Estimated Speed | Estimated Arrival Time | Comments |
|---|---|---|---|---|---|---|
| 17/1506 | Partial | Filament | N30W10 | 500 km/s | 20/2300 UTC | Faint CME. Low confidence, only small chance of side glance. No significant impacts expected |

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## Radio Blackouts - X-Ray Flares:

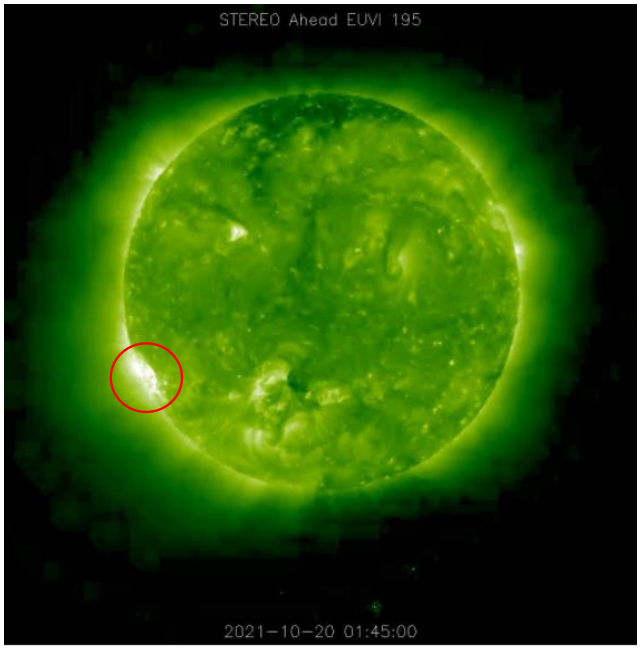
Solar activity is expected to remain at Very Low levels on day 1 and early day 2 (19th and 20th), with only a slight chance of C-class flares, increasing to a chance of C-class flares from the middle of day 2 onwards.

There is one numbered sunspot region on the visible disc at present, AR2886 (Hsx/Alpha), located in the southeast quadrant. This region appears to be stable at present and has not produced any notable flares in the past 24 hours. A small area of plage in the far northeast may contain one very small, faint spot and will be monitored for any development.

A bright region of flux observed near the eastern limb of STEREO-A EUVI imagery (around S22 E105), should reach the east limb of the visible disc later on the 21st or early 22nd. Two A-class flares observed in GOES16 X-ray flux data at 20/0620 and 20/0840 UTC appear to be from this farsided region, suggesting the region needs to be monitored. This results in marginally increased M-class flare probabilities for days 3 and 4.

| X Ray Flares | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability | | | (%) | (%) | (%) | (%) |
| Active | R1-R2 M Class | No | 1 | 1 | 3 | 3 |
| Very Active | R3 to R5 X Class | No | 1 | 1 | 1 | 1 |

**Figure 2: STEREO A EUVI195 imagery 20/0145 UTC with bright flux region in SE circled.**

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## Solar Radiation Storms - (High Energy Protons):

With no significant flare activity forecast for this period, solar radiation storms are not expected.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 1 | 1 | 2 | 2 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

## High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is likely to reach moderate levels through the diurnal cycle at first, and perhaps more generally later in the period, once any increased geomagnetic activity from anticipated coronal hole influence begin subsiding. However, the timing and strength of connection with the coronal hole high speed stream remains only moderate confidence, due to the differing size and location of CH13/- on this rotation.

Associated electron fluence is expected to remain below the active threshold, but is likely to see a rising trend through the period.

| GEO Electron Environment Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ 2 MeV ≥ $1x10^8$** | No | 1 | 10 | 20 | 30 |
| **Very Active** | **≥ 2 MeV ≥ $1x10^9$** | No | 1 | 1 | 1 | 1 |

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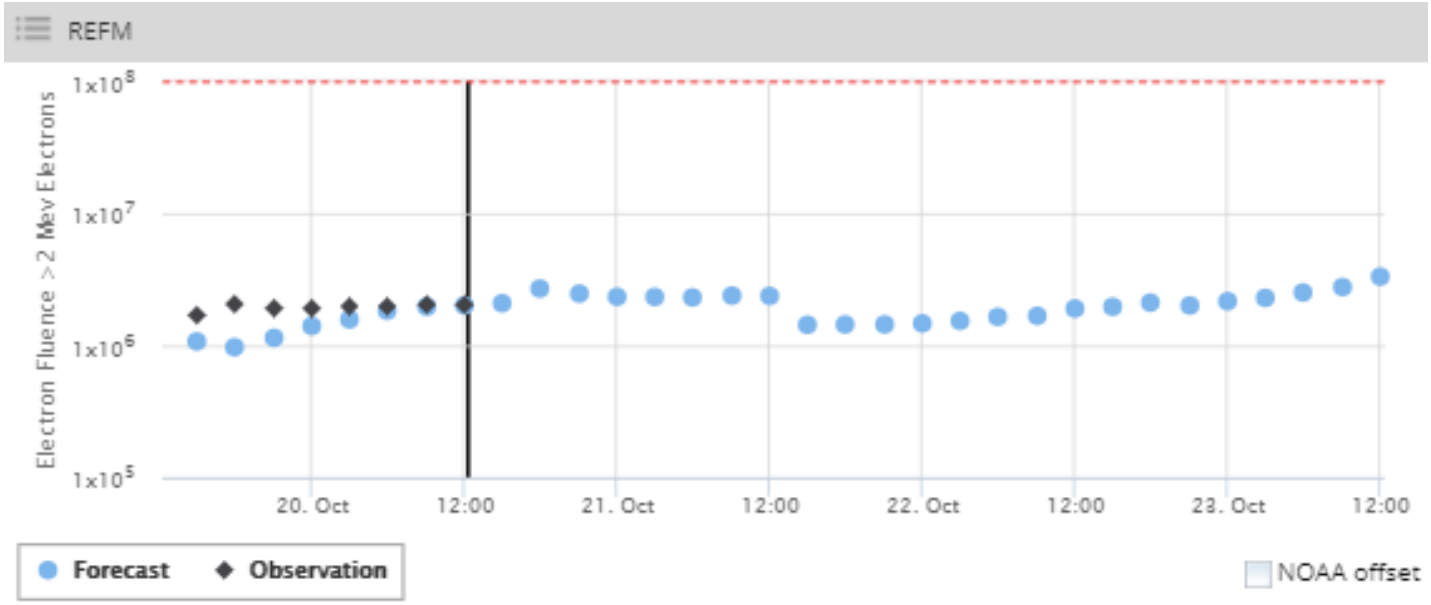
**Figure 3: Latest REFM output from MOSWOC**

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